Epic Online Technology Meeting
Mini/Micro LEDs

Forming Micro-LEDs with Micro Transfer Printing Technology

March 25th 2021
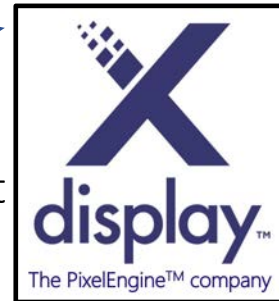
Alexandre Chikhaoui

X-Celeprint Ltd, Company Introduction

HQ - Ireland, Cork

US-North Carolina

- Who we are: Technology Development company focused on advanced micro assembly
- Core Technology: Micro Transfer Printing
- What We do: Adapt Micro Transfer Printing Technology to customer specific applications
- Business Model: Licensing
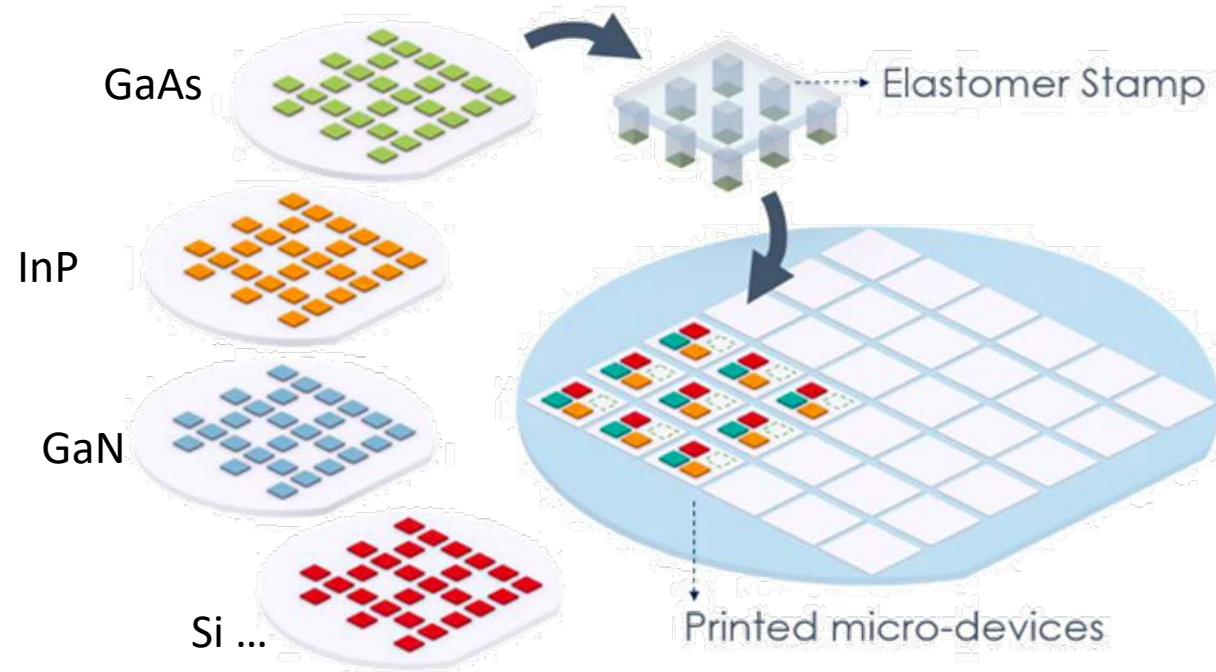- Some Key markets: Photonics, Power Management, Automotive, Medical, Authentication

- Product and Licensing Company
- Focused on Display applications

- End of 2019
  X-Display was spunout
  from X-Celeprint

MTP Technology – Enabling True 3D-Heterogeneous Integration (3DHI)

GaAs

InP

GaN

Si ...

→ Elastomer Stamp

Printed micro-devices

Densely packed Chips from different source wafers are transferred to the destination target and then interconnected
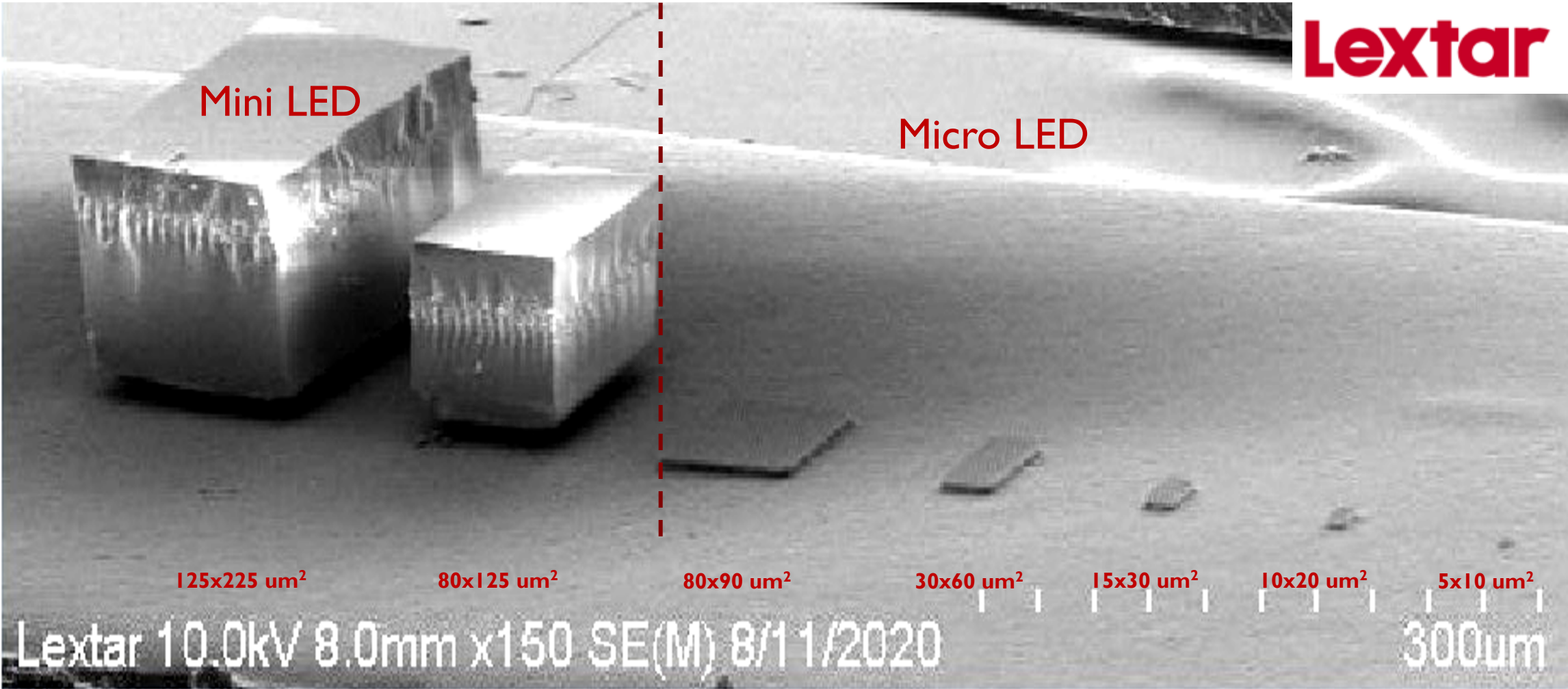
MTP enables True 3D Heterogeneous Integration
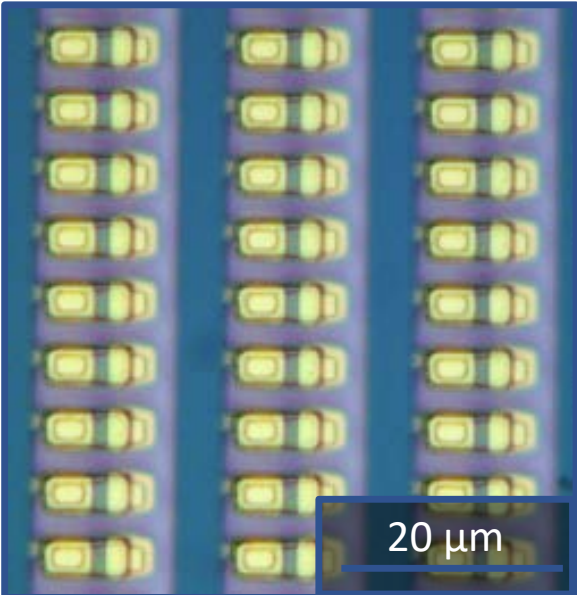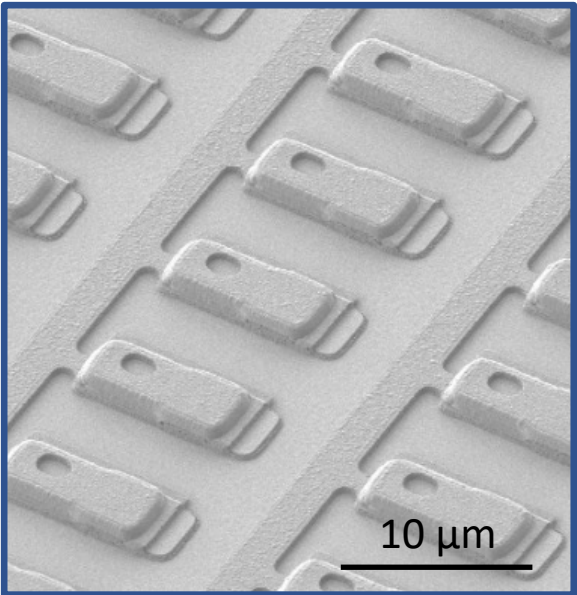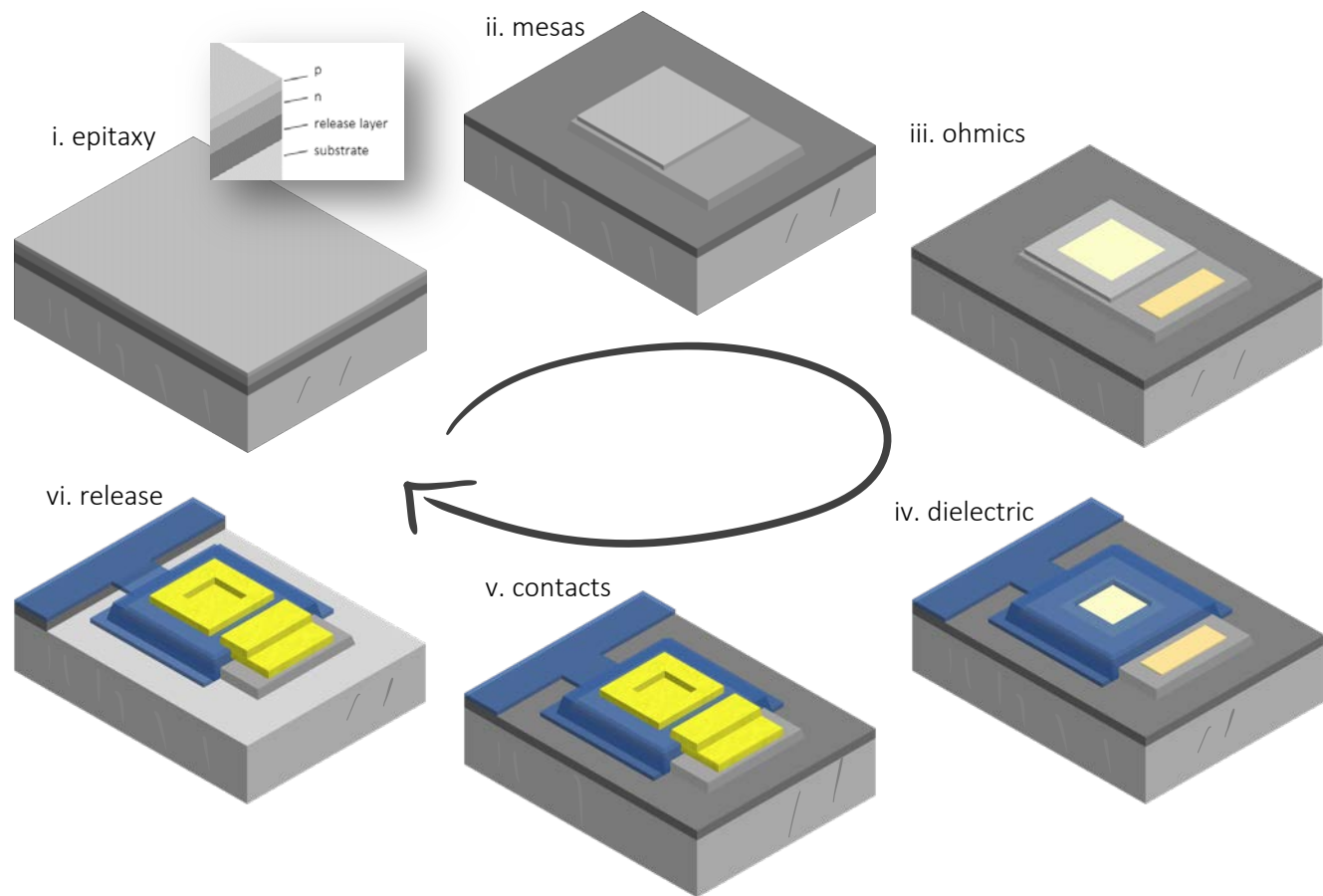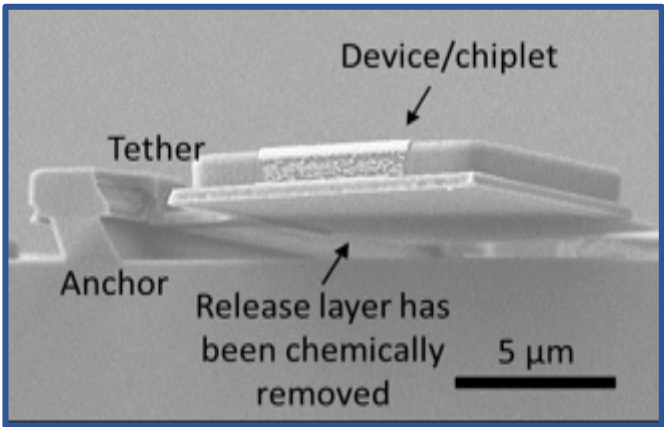

Production Printer "MTP 200A"

From Mini to Micro LEDs

Mini LED

Micro LED

Lextar

125x225 um²   80x125 um²   80x90 um²   30x60 um²   15x30 um²   10x20 um²   5x10 um²

Lextar 10.0kV 8.0mm x150 SE(M) 8/11/2020   300um

Picture is courtesy from Lextar

Gan on Silicon Micro LED Process Flow Example

i. epitaxy

ii. mesas

iii. ohmics

iv. dielectric

v. contacts

vi. release

p
n
release layer
substrate

10 μm

20 μm
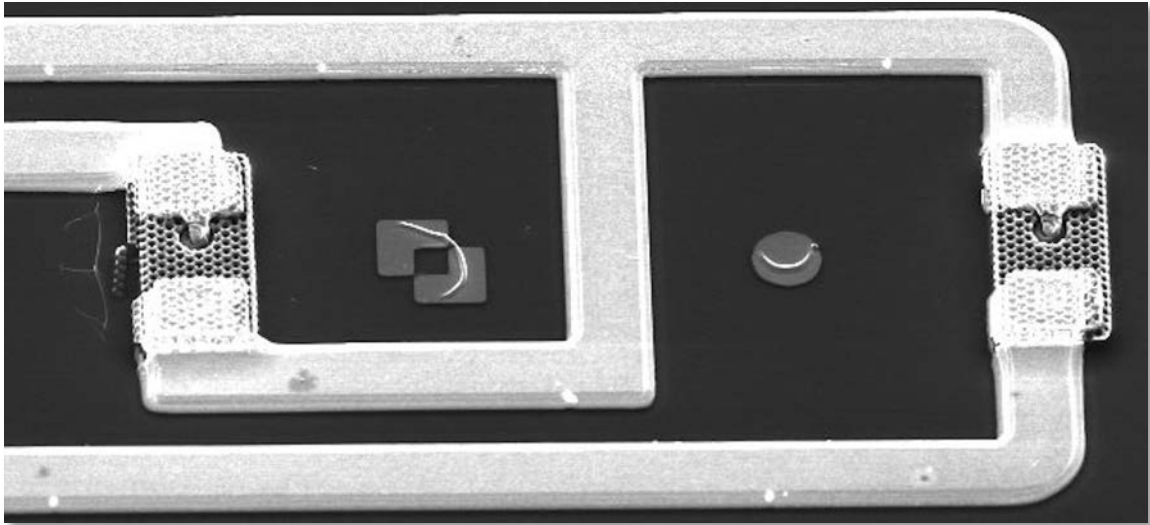
Horizontal 3 x 10 μm² Gan On Silicon μLEDs fully released and floating onto the Silicon Substrate -> Print Ready !

Device/chiplet

Tether

Anchor

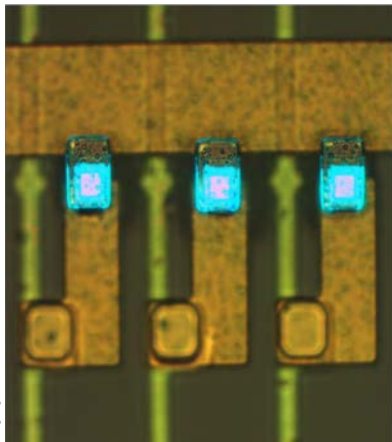Release layer has been chemically removed
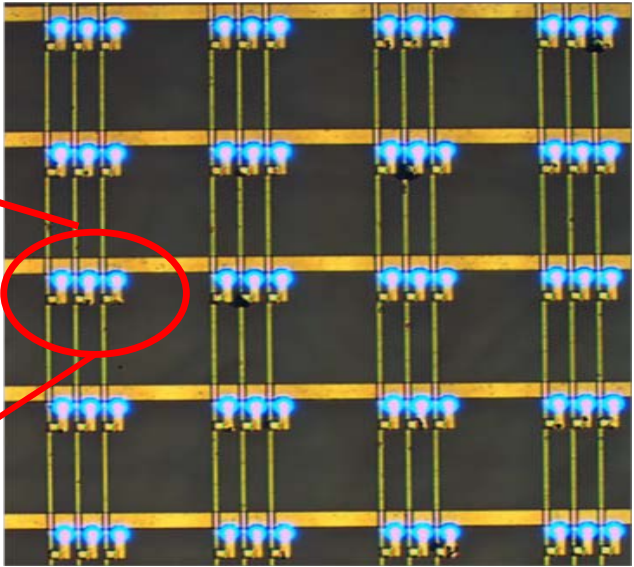
5 μm

Gan on Sapphire Micro LED
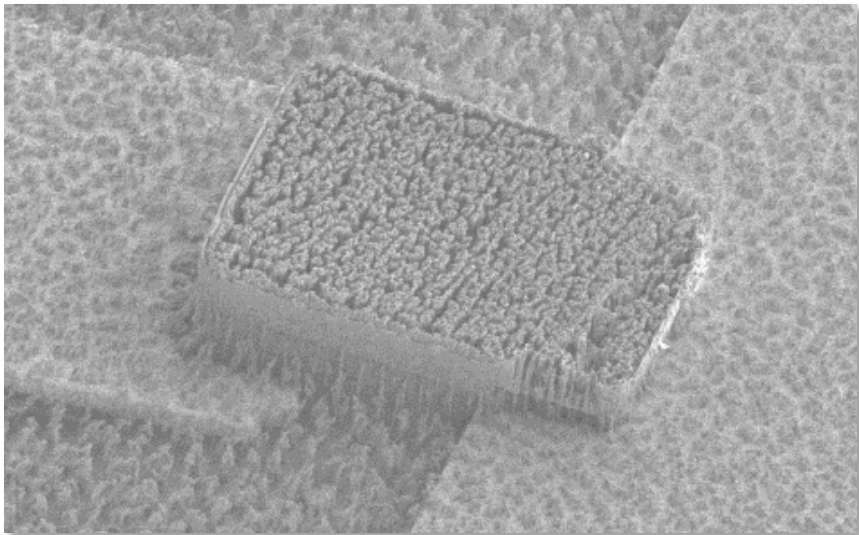
Flip Chip Gan/Sapphire Micro LED
(Bottom P/N Pads)
Interconnected at print

PSS - Gan/Sapphire Micro LED
(Top P/N Pads)
with Thin Film Interconnect

Array of BBB µLEDs
Interconnected at Print

Micro LED Mass Transfer by MTP

- MTP Processes have been developed for numerous form-factors and types of micro-LEDs

  - Gan on Silicon (Green and Blue)
  - Gan on Sapphire (Green and Blue)
  - GaAs (Red)
  - Lateral and vertical
  - Top Pad and Flip Chip
  - 3x10um; 8x15um; 30x60um …

10,000 posts Stamp with UPH > 1M devices/hr
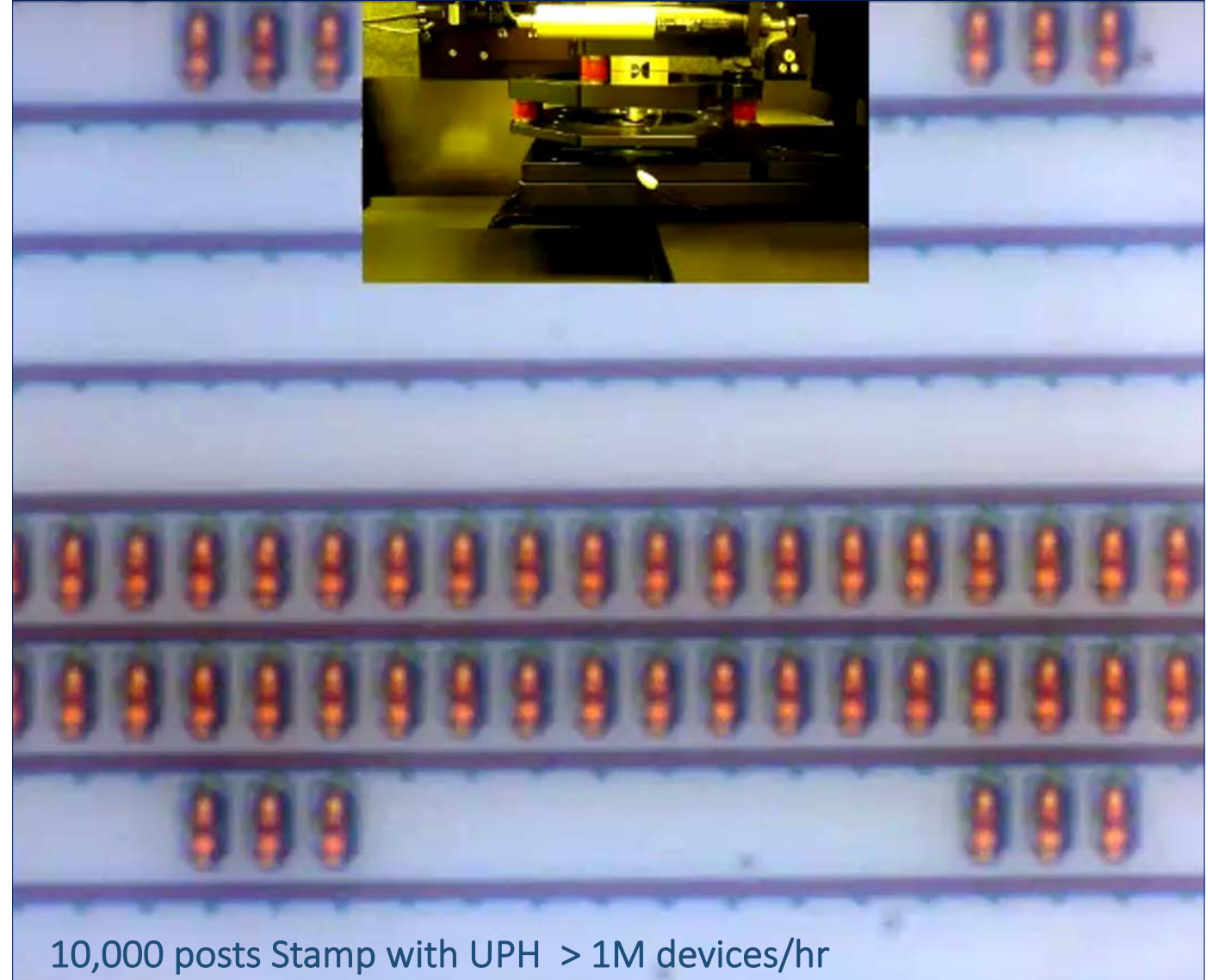
True 3DHI Opens Unlimited Possibilities for Next Generation High End Displays

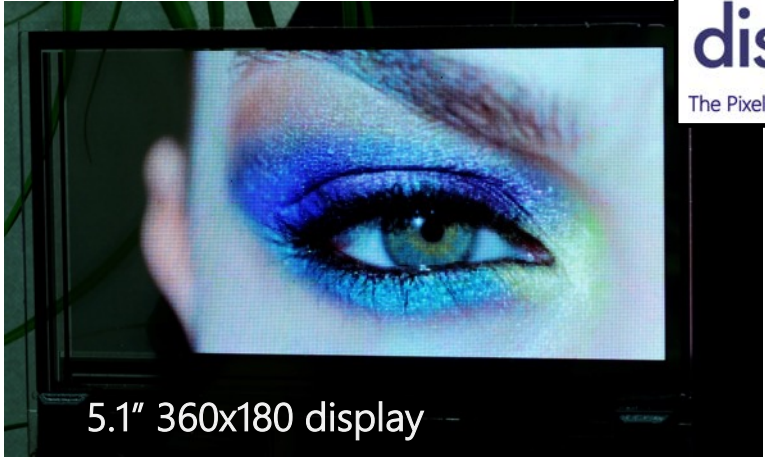

70x35 μm^2 **RGB** package

50 μm
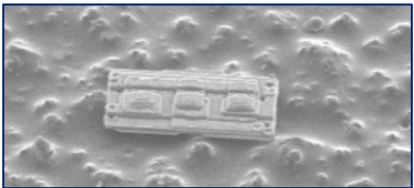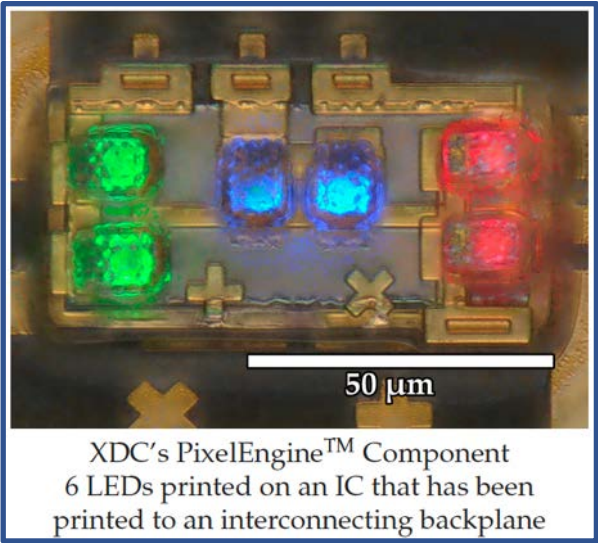
XDC's PixelEngine™ Component
6 LEDs printed on an IC that has been
printed to an interconnecting backplane

LED Driver + **RGB** package
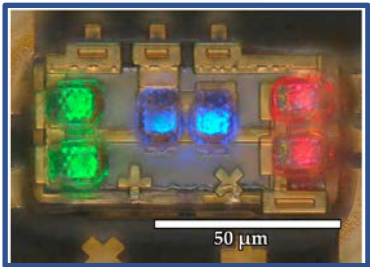

5.1", 70ppi, 73% transparency

5.1" 360x180 display

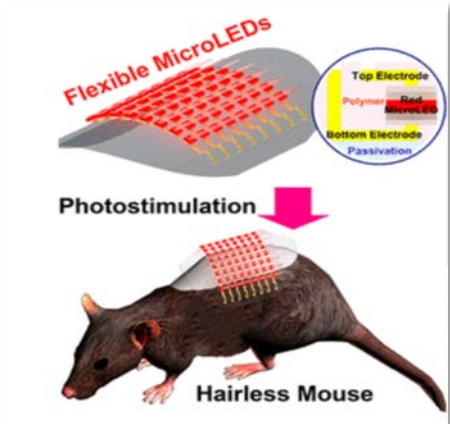Pictures are courtesy from X-Display™

Multiple Applications Beyond Displays

Display	Medical	Automotive	Authentication

Micro LEDs + LED driver

Micro LEDs	Sensors
Micro LED Driver	

Micro LEDs	LED Driver
I/F + Micro Controller	

Micro LEDs	Power
Controller + Memory	

3DHI Micro SYSTEMS by MTP

MTP Adoption and Ecosystem is Growing

- **MTP prototyping at R&D lines:**

Naval Research Laboratory

- **First MTP-ready foundry service:** ✖FAB **CMOS 0,18um SOI (XT018)**

- **MTP manufacturing systems available now from multiple manufacturers**

ASM AMICRA
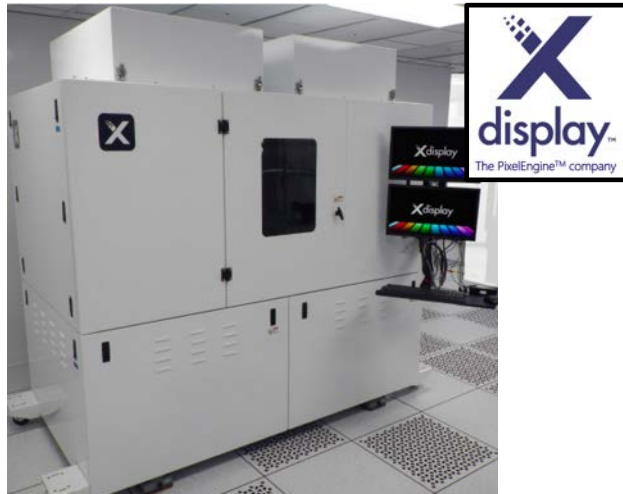
- **MTP licensees for microLEDs growing***

OSRAM Lextar

(* Publically disclosed)

Thank you